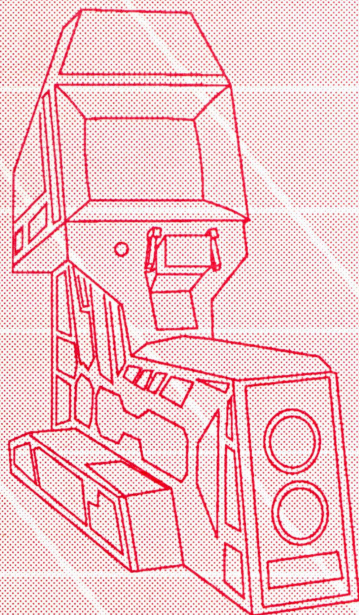
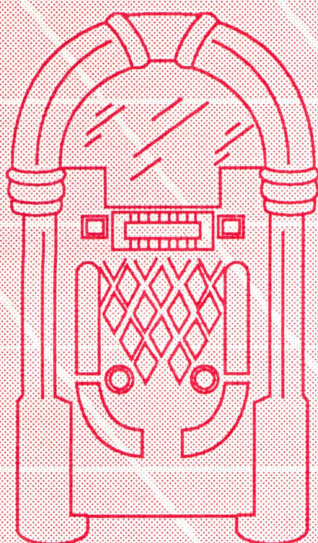


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For The Coin-Op Industry

Journal

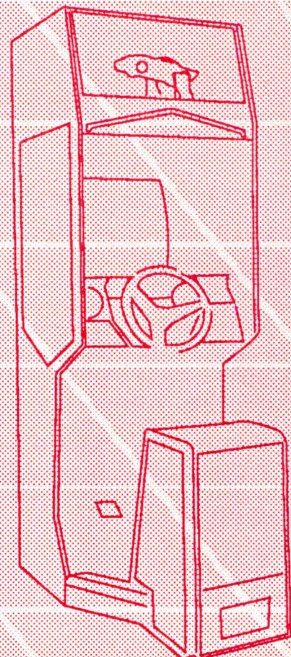
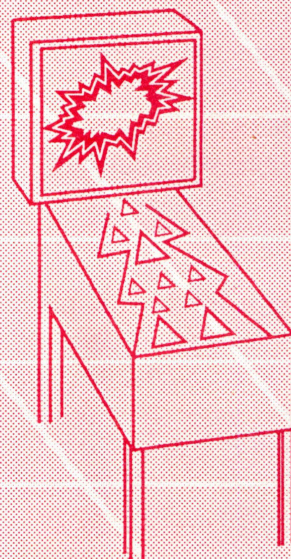


August 1990

Volume 12, Number 6

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Fluke 70 Series Analog/Digital Multimeters

Feature-Packed Handheld Meters Provide Unbeatable Performance and Value

- 3-1/2 digit, 3200 count display
- 31 segment analog bar graph
- Single rotary dial to select all functions
- Autoranging and automatic polarity selection
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- Three year warranty



These digital multimeters with analog bar graph displays take advantage of the latest advances in microcircuit technology to provide uncompromising quality and capabilities. The result is a series of high-performance meters with combined features never before available, even on more expensive instruments.

Operating any of the Fluke 70 Series multimeters is exceptionally simple. Choose the function you want, connect the test leads, and the meter automatically selects the correct range.

ANALOG/DIGITAL DISPLAY

The high-resolution 3200 count digital display delivers better accuracy than conventional 3-1/2 digit DMMs. A 31-segment bar graph reacts 10 times faster than the numerical display, making peaking and dipping adjustments easy.

FAST AUTORANGING

Simply choose a function and the meter automatically selects the range with the greatest accuracy and resolution. Symbols on the liquid crystal display show what function is being measured and the range of measurement.

AUDIBLE CONTINUITY/DIODE TEST (FLUKE 75 AND 77)

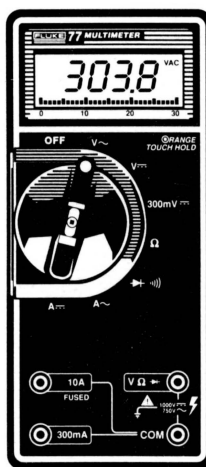
A continuous audible tone provides a fast check for continuity of current paths having 150 ohms or less. A brief tone indicates a voltage drop of about 0.6 volts, the normal forward bias for semiconductor devices passing about 500 uA.

TOUCH HOLD (FLUKE 77)

This feature allows automatic measurements while watching probes and circuits. The meter captures the measurement, beeps, and locks it in the display until you're ready to view it. It automatically updates with each new measurement.

STANDARD EQUIPMENT

All 70 Series meters are packaged with a pair of safety-designed Fluke TL70 right-angle test leads, operator's manual, battery and spare fuse. The multi-purpose C70 holster is included with the Fluke 77.



BASIC ACCURACY (% of reading + # of digits)

	73	75	77
DC Voltage	0.7%+1	0.5%+1	0.3%+1
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BATTERY LIFE: 2000 hours typical.

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SIZE: 1.12" H x 2.95" W x 6.55" L. **WEIGHT:** 12 oz.

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Fluke 73	\$ 77
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Publisher/Editor:
Office Manager:
Project Manager:

James Calore
Sharon DiRenzo
Neil Calore

Contributors:

Reinhard Bangerter
James Beck
Frank Becker
Jim Kelly
Greg McKay
Dave Peckels
Mark Sherman
Phillip G. Stewart
Todd Tuckey
Evan Wessel

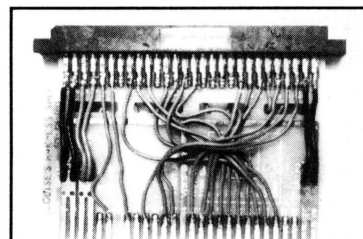
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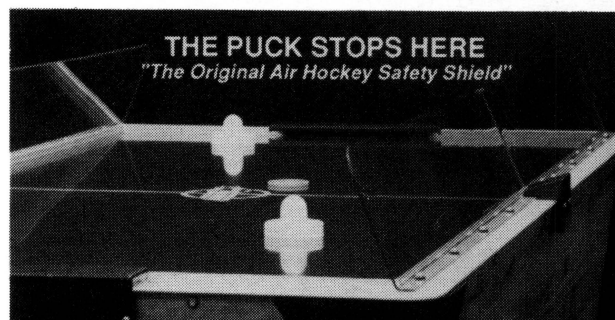
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Double Male Interface Board with JAMMA pinout one side and choice of either 28/56, 22/44 or 18/36 on other side. Male/Female Interface Board with JAMMA printout on male side and choice of 28/56, 22/44 or 18/36 female connector on other. All boards have provisions for jumpers from one side to the other. Boards wired to your pinout. **Nintendo Monitor Color Conversion PCB** Simple installation, instructions furnished. Quantity prices on request. Prices subject to change without notice.

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Merit Pub Time II Plus 2 New Eprom

Jim Kelly
Merit Industries
Bensalem, Pennsylvania

PROBLEM

If a coin is inserted while the game is producing musical sounds, the game will lock up. The game would have to be turned off, then on again to clear. The game would retain your credit and you could continue play.

SOLUTION

There is a new updated program Eprom available through your local Merit distributor. This Eprom is located on the main logic board (RDP01) in the back of the target section.

INSTALLATION

Remove the original Eprom in location U7 (Program #4378-01 U7-0, OA or OB). Replace it with updated Eprom program #4378-01 U7-OC. If there are any questions call Merit Customer Service at 1-800-445-9353.

Wms Black Knight 2000 Lock-Up

Service Shop
New England Pinball Service
Derby, Connecticut

PROBLEM

We have received 9 BK-2s for service, all with the same problem - when the start button is pushed the game locks up.

CAUSE

Loose set screws.

SYMPTOM

The wheel that moves the draw bridge up and down has a set screw that holds it onto the travel motor. If the screw loosens up while the bridge is mid travel, the wheel will not activate the up or down micro switches. This will shut the game down.

SOLUTION

When retightening the set screw, be sure that the screw is on the flat of the motor shaft. Apply a small amount of *Lock-tite* to prevent any recurrence.

Wms Black Knight 2000 Opto Targets

Evan Wessel
Mercury Amusements
Havertown, Pennsylvania

PROBLEM

I have been having a problem with the drop targets not resetting properly. Sometimes they just stay down all the time.

I checked for bad solder joints and also checked for bad connections on the molex connectors but have found no sign of a problem. I seem to be able to fix it temporarily by wiggling the boards a little.

SOLUTION

I had that problem where jiggling the drop target PCB would bring the targets up and it turned out to be a bad optocoupler. Try checking for dirt on either side of the opto (photo-coupler). Cleaning both sides of the opto will often solve the problem you describe.

If not, try replacing *all* of them and that should fix the darn thing. Oh, I miss the old fashioned microswitches. Who said fancy is more reliable?

Atari Hard Drivin' Substitute Pot

Reinhard Bangerter
Nickels & Dimes
Laguna Hills, California

SUBJECT

Want to save some money? If you don't like the price of the *Hard Drivin'* steering pot from Atari here is a substitute: Spectrol 534, 7/8" shaft, 10 turn, precision, wirewound, potentiometer.

SOURCE

Its available from Mouser Electronics 1-800-34-MOUSER. Part# 59453411103. Price: (get this!)... \$9.45!!! in single quantity.

NOTE

Because the threaded mounting collar is not threaded all the way down, you may want to use a 3/8" flat washer for a tight fit. We have been using them for over two months now without any apparent problems.

ALTERNATE

A similar part is available from Digi-Key 1-800-DIGI-KEY (Clarostat). Part# 73JA103-ND. Price \$10.42 (haven't tried this one, I don't want to pay the extra buck!)

NOTE

Both of these models are the metal shaft versions but each offers a nylon shaft version for about half price, but I wouldn't use it.



Atari Notes For Hydra Kits

Mark Sherman, Customer Service
Atari Games
Milpitas, California

BOOST LIGHT

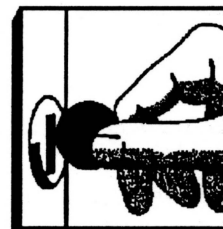
Connect one side of light bulbs to +5 volts. Connect other side to connector JL Pin 2 on main PCB. Pin #4 is the key pin on connector JL.

CONTROLS

After hooking up controls go to switch test and calibrate controls. See pages 2-5 and 2-6 of manual.

FOOD PEDAL

Hook up white wire to y/w wire pin Y on JAMMA connector. Hook up red to +5 volts, black to ground and the green to earth ground.



Deadline for *STAR★TECH Journal's* Fall Direct Mail Package is coming... Prepare now to reach every Coin-op just prior to the AMOA '90 Expo.

There is no more economical way to announce your new product, sell your services or move your inventory. Your flyers will be going out to the most complete & current mail list in the industry!

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New Utility on S★TJ's BBS Makes Look-ups A Snap!

Looking for a particular game, subassembly, component, parts source, author or any subject that might be on the electronic bulletin board, but don't have the time to spend looking through all the messages?

A new utility now available makes this task a snap. it's called *BAMscan* and the software was written by James Beck, Sysop for *STAR★TECH Journal's* BBS (electronic Bulletin Board System). Phone: 404-631-2928. Modem speed: 2400, 1200, 300. Data bits: 8. Parity: N. Stop bits: 1. This service is free to subscribers.

MAKE A SELECTION:

- 1) Search Message Areas.
- 2) Get some help.
- 3) Go back to the BBS (quit).

Selection? 1

WHICH AREA DO YOU WISH TO SEARCH?

- 1) "General Interest Message Area"
- 2) "STAR★TECH Journal Customer Service and Feedback Area"
- 3) "For Sale and Want Ads Area"
- H) for Help screen.
- Q) to Quit to previous menu.
- B) to go Back to the BBS.

This *BAMscan* utility is very similar to the OPUS internal "(I)nquire" command, but unlike the "Inquire" command, which allows you to only search the To:, From:, and Subject: of messages, the *BAMscan* utility searches the ENTIRE message for a specific word or string. It also allows for a second keyword or string and conditional testing.

USING BAMSCAN

The main utility menu gives you 3 choices. To search a message area, get some help, or to go back to the BBS. That's pretty straight

forward. The next menu lists the available message areas that you can search.

If you choose to perform a search, you will be prompted for a "keyword". This is the word or string of words you want to find. Try to be as brief as possible to ensure a match. Upper and lowercase are ignored.

You will then be asked if you want to enter another keyword. If you don't, the search for your keyword will be started in the chosen message area. If you opt to enter another keyword you will then be prompted for the next keyword, and a conditional test to be performed during the search.

THE CONDITIONALS ARE:

& for AND
* for OR
! for NOT

This lets you search for messages that contain the first keyword AND the second keyword, messages that contain the first OR the second keyword, and messages that contain the first keyword but NOT the second. The possibility to search for very specific information in this way is enormous.

After the search begins, any message numbers that constitute a match of your criteria will be displayed. You can then try another search, or go back to the BBS to read the matches.

Life on the BBS is now considerably simpler. Enjoy!



DJ Boy Logic Board Lock-Up

Dave Peckels
American Sammy Corporation
Torrance, California

PROBLEM

A small percentage of *DJ Boy* PCB's have developed a lock-up or freezing problem, usually during the attract mode.

SOLUTION

If you are experiencing such difficulties, the distributor from whom you purchased the kit can supply, at no charge, a set of 2 updated Eproms, which will resolve the situation.

Please return the old chips to your distributor as soon as possible. Thank you and we regret any inconveniences that this may have caused you.

Wms Rollergames Upper Rubber Ring

Evan Wessel
Mercury Amusement
Havertown, Pennsylvania

PROBLEM

Changing an upper rubber ring under the ramps on *Rollergames* is a 2 man, 1/2 hour job. The playfield must be lifted out of the game and the ramps must be removed while juggling the playfield on it's side. Definitely not fun.

SUGGESTION

Special service, long-life rings similar to the tan shooter tips that outlast white tips 10 to 1. I realize that they may not have the rebound of white rings, but servicing is more important, in this case.

Upcoming STAR★TECH Journal Regional Seminars

Aug 25/26	<i>Commercial Music</i>	Dallas, TX
Sept 15/16	<i>Struve Distributing</i>	Salt Lake, UT
Sept 22/23	<i>Cleveland Coin</i>	Detroit, MI
Sept 29/30	<i>STAR★TECH</i>	Atlanta, GA

For more information see page 23
or call S★TJ at 609/662-1080.

MURPHY'S LAW #1206

Opportunity always knocks
at the least opportune time.

Hey There Mr. Jukebox Operator!

Are you frustrated at the high cost of a new CD jukebox for that location that just won't justify it?

Well, don't junk those old 45 phonos!

**Convert them with our new
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Kit includes: • 12 disc CD player (add-ons optional; up to 3 players) • CPU board & Control panel with numbered push button keyboard • LED readouts • Price and Play instruction card • Decals • Wiring harness • Hook up instructions • 12 month warranty complete kit.

For more information, call the

CD JUKEBOX KIT CO., Inc.

at 901/364-5140 or
fax 901/364-3134.

Williams Rollergames Deep Freeze Adj

Greg McKay, Service Department
Williams Electronics Games, Inc.
Chicago, Illinois

SUBJECT

Rollergames "Deep Freeze" Magnet Performance Adjustments

INFORMATION

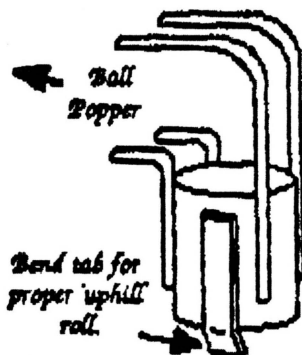
Three adjustments are recommended, to ensure proper "Deep Freeze" Magnet operation. Determine which is applicable for your game. (Some games may need only one; some may need more than one.)

The first adjustment affects the ball direction, as it exits the tube at the end of the *Ball Popper Wire Ramp*. The second adjustment affects the *ball location* when frozen by the magnet. The third adjustment affects the *magnet core height*.

BALL POPPER WIRE RAMP EXIT TUBE ADJUSTMENT

PROCEDURE

1. Check the direction and distance of ball movement as it exits the Ball Popper Wire Ramp tube. As it drops out of the tube, the tab at the bottom of the tube should send the ball rolling uphill (upward on the playfield) approximately 1 inch, before rolling down the ball guide into the "Deep Freeze" Magnet region, near the Upper Right Flipper.



2. Adjust the tab at the lower end of the Ramp tube to obtain the proper uphill roll. Be careful of the uphill roll distance because too long an uphill roll can cause the ball to gain too much momentum and roll completely through the magnet area too fast for the magnet to freeze

(hold) it. Also, be careful of the direction of the roll. The tab should direct the ball slightly toward the ball guide to ensure that the ball will roll through the magnet region, rather than possibly bouncing away from the magnet region.

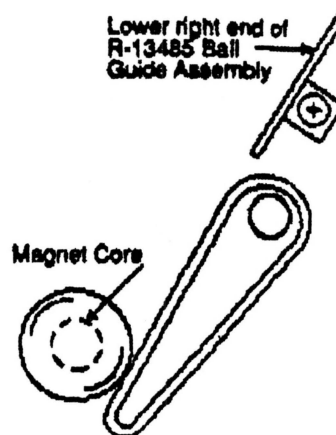
UPPER RIGHT FLIPPER PADDLE ADJUSTMENT

PROCEDURE

1. Check the ball movement as the magnet freezes (holds) it. Ideally, the ball will be rubbing on the red flipper rubber, during the freeze. This dampens the magnetic oscillations much faster and allows a well-aligned shot up the left Upper Plastic Ramp.

2. Adjust the Upper Right Flipper paddle position, if possible, to allow the ball to rest on the red flipper rubber, while the magnet is holding it.

3. Be careful during this adjustment to avoid making the loop shot around the ball guide at the top of the playfield end in an outhole drain (up the left side of the ball guide, around the upper rim, and down the right side of the ball guide, past the flipper paddle, and down between both lower flippers into the outhole). The Upper Right Flipper paddle should send the ball onto the lower right flipper, when properly adjusted.



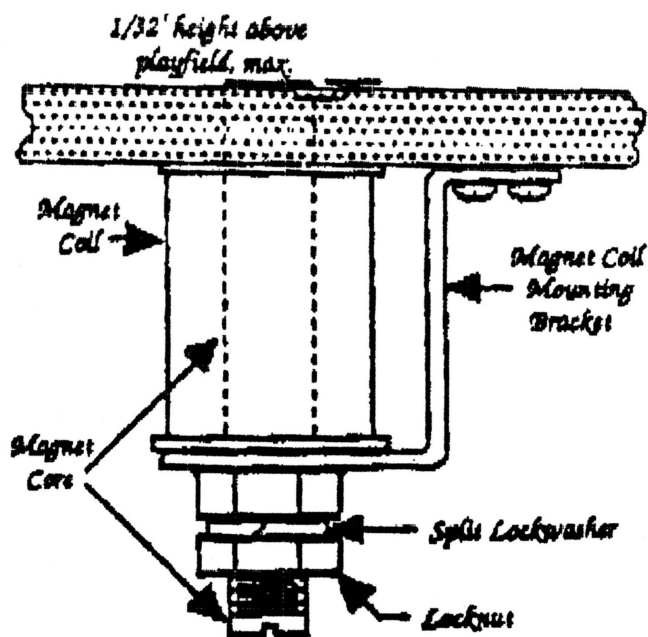
Ball resting on Upper Right Flipper rubber, during Magnet 'Freeze'

MAGNET CORE HEIGHT ADJUSTMENT

PROCEDURE

1. Check the height of the metal "Deep Freeze" magnet core above the playfield surface. The optimum height is approximately $1/32"$. This height causes the ball to freeze faster, by reducing the speed of the ball movement, yet it does not apparently interfere with other shots.

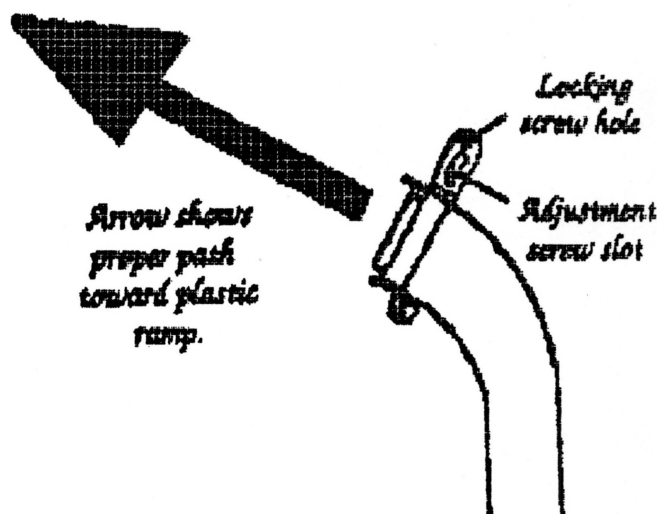
2. Raise the playfield to allow a straight-bladed screwdriver blade to turn the core for the proper height. If necessary, slightly loosen the locknut securing the core in its bracket. Retighten the locknut following the height adjustments to secure the core at the desired height.



SHOOTER LANE EXIT PATH ADJUSTMENT

INFORMATION:

As the ball exits the shooter lane, it should proceed across the playfield and go up the plastic ramp (as shown by the dark arrow). Adjustment of the shooter lane ball guide may be necessary to obtain this ramp shot.



PROCEDURE

1. Check the ball trajectory (path) from the shooter lane ball guide toward the plastic ramp. The ball should move smoothly up the ramp entrance.

2. If necessary, loosen the ball guide screw in the ball guide slot, and reposition the ramp to obtain the proper ramp entry.

3. To maintain the ball guide position, install another screw in the Locking Screw hole.

Data East Speed Buggy Sensor PCB

Phillip G. Stewart, Customer Service
Data East USA, Inc.
San Jose, California

SUBJECT

Data East's Service Department has compiled the following information on the sensor PCBs used in the accelerator, brake and steering assemblies. These PCBs are simple in design and have a low failure rate, however, your feedback and requests has prompted us to compile this information.

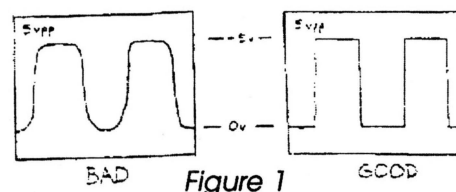
SENSOR PCB

The sensor PCB used in the upright model steering assembly is manufactured by IME in Italy, whereas the accelerator PCB is supplied by the game's creator, Tatsumi. The three monitor cockpit version of *Speed Buggy* utilizes the Tatsumi produced sensor PCBs exclusively. It has been our experience that the Tatsumi sensor PCB is relatively trouble free, whereas the IME PCB has had a slightly higher failure rate.

STEERING CONTROL

One of the most common problems experienced is with losing steering control on the upright model caused by mis-alignment or failure of the optical devices used on the sensor PCB. the input circuitry of the logic PCB requires a perfect signal from the sensor PCB. This signal is basically a square wave, but the LO half of the signal must reach ground potential (0 vdc) for proper operation (see Figure 1).

If the optical devices on the IME sensor PCB are not aimed perfectly at one another, the output signal's LO portion begins to rise above ground potential (see Figure 1), causing the logic PCB to ignore the signal.

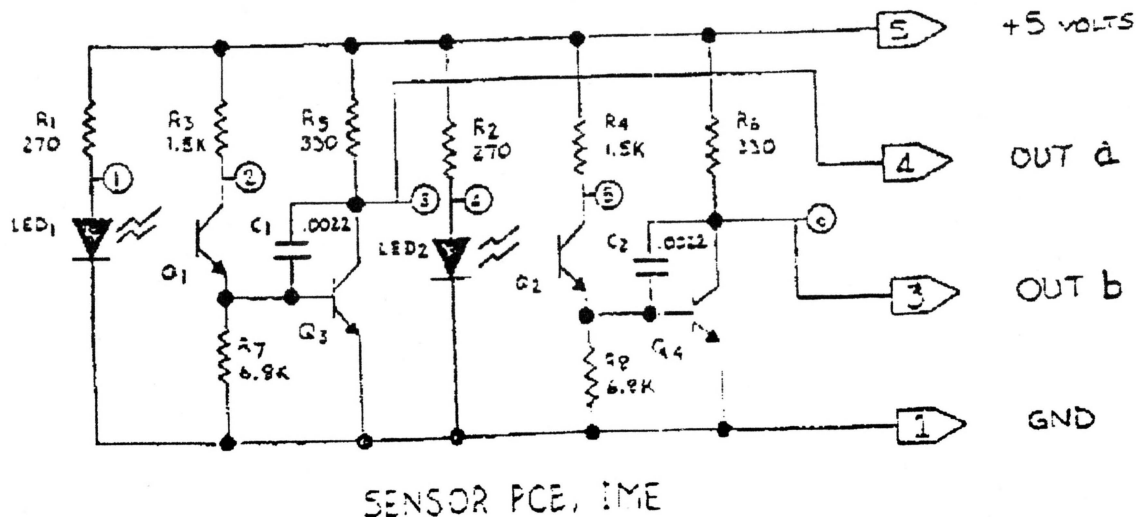


VOLTAGE MEASUREMENTS, IME SENSOR PCB

Test Point	Sensor Clear	Sensor Blocked
1	1.2 vdc	1.2 vdc
2	4.5 vdc	0 vdc
3	0 vdc	5.0 vdc
4	1.2 vdc	1.2 vdc
5	4.5 vdc	0 vdc
6	0 vdc	5 vdc

NOTES

1. *Sensor Clear* means that there is no object between the LED and the photo-transistor. *Sensor Blocked* means that an object has been inserted between the LED and the photo-transistor. A business card or any flat card stock is suitable for this purpose.



This board is used on a number of games other than Data East.

2. Refer to the schematic diagram for Test Point locations.

3. All voltage measurements are measured with respect to ground.

REPLACEMENT PARTS

The following list represents the commonly available semiconductors used on the sensor PCB, location and Data East part number. If you cannot locate a specific part in your area, you may order parts from your Data East distributor.

IME Sensor PCB, PN 520-0074-00

<u>Description</u>	<u>Location</u>	<u>Part Number</u>
LED, IR, SFH409	LED1, LED2	165-0007-00

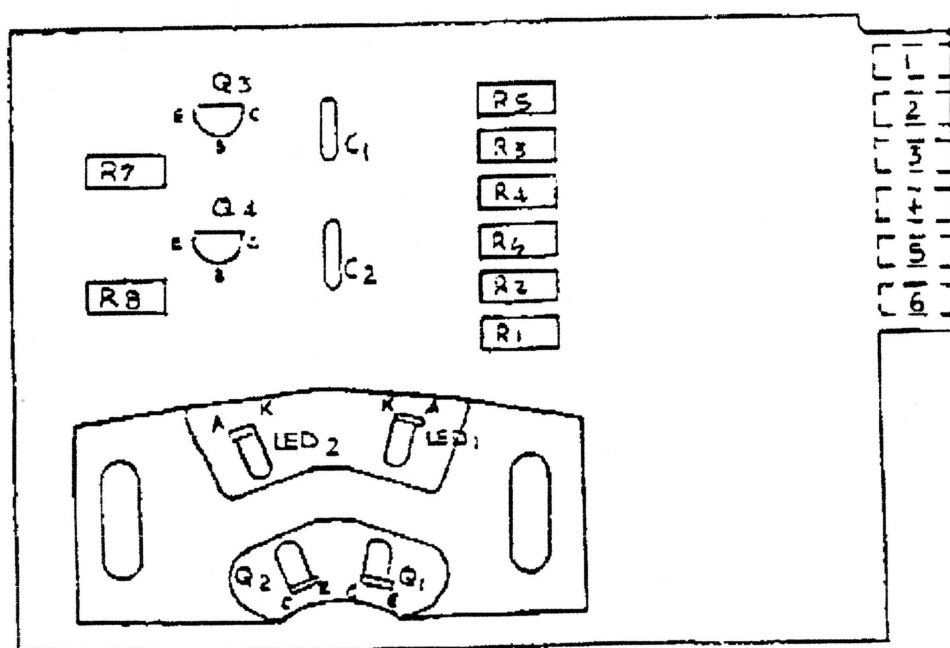
Sensor, SFH309	Q1, Q2	160-0003-00
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Transistor, NPN, 2N2222	Q3, Q4	110-0066-00
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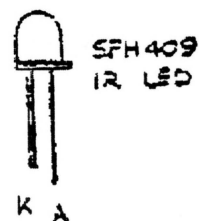
Tatsumi Sensor PCB, PN 520-0060-00

<u>Description</u>	<u>Location</u>	<u>Part Number</u>
Sensor, GP1A01	n/a	160-0002-00

The illustration below shows the component locations on the IME PCB and the package outlines of the SFH309 and the SFH409 devices to aid replacement installation.



TOP VIEW



MicroProse Games *F-15* Update

Where To From Here...

Frank Becker
MicroProse Games
Hunt Valley, Maryland

SUBJECT

Thought I'd give you guys an update and a peek into the *F-15* hangar.

Distributor and operator response to *F-15* has been very positive. Both have kicked the tires and have provided ideas about game play and construction that we tried to incorporate into our production version.

After attending several distribution shows, we started on the path that every manufacturer travels to help insure a strong earning piece - focus groups, field tests and the requisite code changes.

PROBLEM

Our problem was that people didn't know how to fly when they had total control of a real plane for the first time.

SOLUTION

Therefore, we added a "greased rail" in the beginners level that keeps the player confined to a track that travels between two mountain ranges while offering a plethora (big word of the day) of targets.

This insures that the player has fun while he learns to fly. As the player advances, he gains total control of the plane which increases the thrill and realism of the game; at this point he isn't a player any longer, he's a fighter pilot!

ADDITIONAL LEVELS

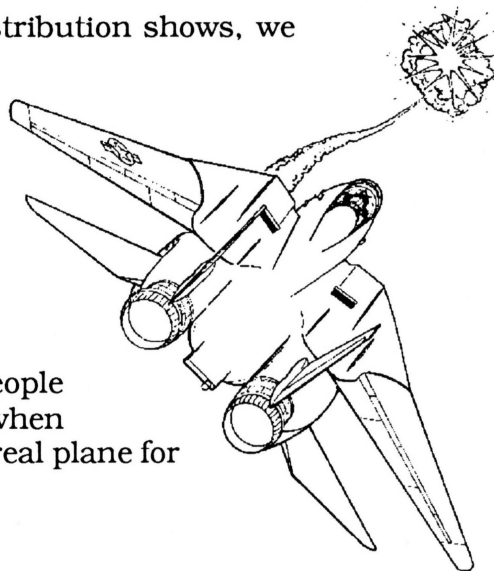
There are six arenas, in addition to the "greased rail" or gauntlet arena. The player chooses one of three difficulty levels and flies through each arena in pursuit of the *Congressional Medal of Honor*.

EARNING POTENTIAL

Game play hints give players a chance to increase their scores and entice them to play at more advanced levels. This attention to the desires of arcade gamers, combined with unique buy-in features, results in a game with sustained player appeal and high earnings.

BOTTOM LINE

So in short, no problem at all, just the normal hoops that you have to jump through to produce a good game. We've had it out on some test flights and once she's all tuned we'll let you take her up.



Wheels up near the end of September.

National Technical Seminar Outline

STAR★TECH Journal's well received national technical seminar program offers advancing technicians a way to increase their level of expertise. Hundreds of industry techs have received valuable training across the country. The student critiques are overwhelmingly favourable (over 93% rate the seminar excellent overall). While the program is constantly updated to stay current with industry technical trends, the following outline is in effect.

STAR★TECH JOURNAL SEMINAR PROGRAM

Class Hours:

Saturday 9:00-12:00 am (Break) 2:00-5:00 pm

Sunday 8:00-11:00 am (Break) 12:30-3:30 pm

1: RUNDOWN ON MINIMUM REQUIRED TEST EQUIPMENT FOR COIN-OP REPAIRS.

- a. What it takes to get the job done.

2: TROUBLESHOOTING VIA PHONE.

- a: Getting good information.
- b: Question checklist.

3: POWER SUPPLIES.

a: Linear

- 1: Low Voltage
- 2: High Voltage
- 3: Common failures

b: Switch Mode Supplies

- 1: Single Voltage Supply
- 2: Multivoltage Supply
- 3: Common Failures

c: Useful Tips

d: Semi-Conductor replacements

4: MONITORS (CONCENTRATING ON THE NEW W-G K7000 & HANTAREX MC9000).

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- b: Horizontal Output Section
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Cautions, Precautions & Observations

Piggy Back PCBs, CPU Sockets, WG Med Res, Surface Mount Caution,
CRT Blaster, Wms Test Rom, Cabinet Alert

James Beck
Greater Southern Distributing
Atlanta, Georgia

CABINET ALERT

Watch out! Some HS-9 cabinets have been miswired so the "earth" ground going to the monitor is connected to neutral and neutral is connected to ground. That isn't too much of a problem as long as the outlet is wired OK otherwise YOU could get knocked for a loop. The main symptom that you can visibly see is a definite "Hum Bar" in the video due to the hot returning via ground.

WMS TEST ROM

This new "Williams Test ROM" being sold by a second source for close to \$100 is NO better than having a known good set of F-14 ROMs laying around.

CRT BLASTER

Heath Kit sells a good CRT rejuvenator for close to \$100 that does everything the \$450 B&K Precision does and all you have to do is solder it together. It will pay for itself the first time you use it.

SURFACE MOUNT CAUTION

Surface mount IC's should NOT be screwed with by anyone but a qualified tech that has access to the PROPER rework tools.

WG MEDIUM RESOLUTION

Wells-Gardner K7000 monitors that have been adapted to "Medium Res" (i.e. 24 KHz) blow horizontal drive transformers right and left.

CPU SOCKETS

Manufacturers should socket their CPU's so it is easier to plug your ICE system into the suckers without having to either destroy or thermally stress the CPU.

PIGGY BACK PCB

Manufacturers who stick their ROM boards on top of the CPU board with connectors that make it impossible to troubleshoot the CPU board without special extenders should be subjected to a close-range thermo-nuclear blast.

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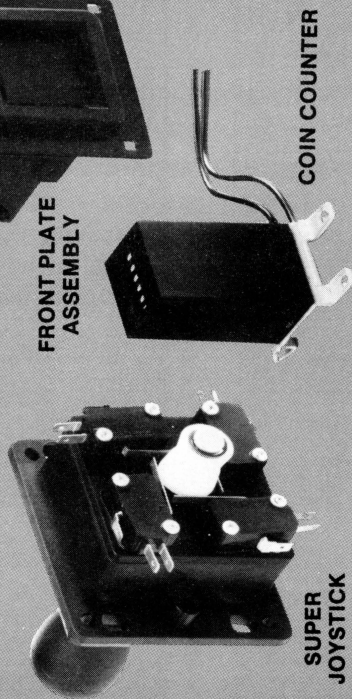
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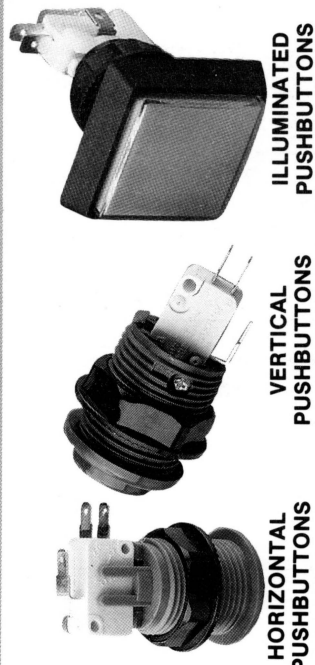
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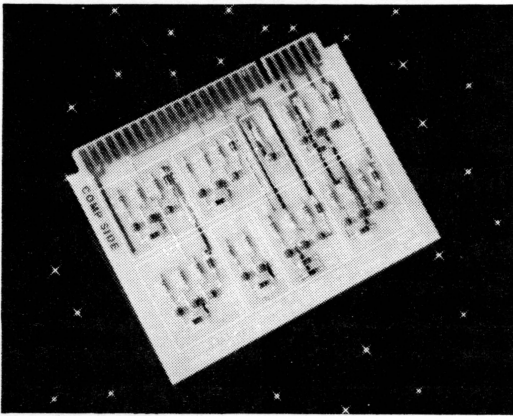
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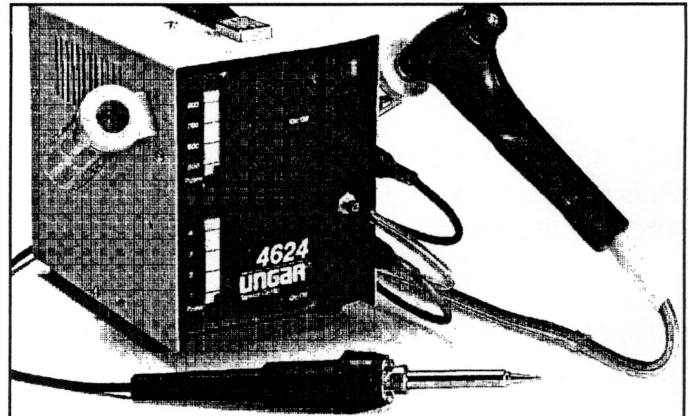
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Williams Rollergames Assy Improvement

Greg McKay, Service Department
Williams Electronics Games, Inc.
Chicago, Illinois

SUBJECT

Rollergames Upper Diverter Assembly Improvements

CHANGES

Improvements to the Upper Diverter Assembly, p/n C-13489, include;

- (1) a coil change (replace the AE-23-800 coil with one marked AE-26-1200);
- (2) a Solenoid Bracket Assembly, p/n B-13488, change and
- (3) a change to the assembly comprising the coil plunger, drive link and spring.

ORDER

It is suggested that these changes occur in the order listed in the preceding paragraph; that is, coil replacement should be first, followed by replacing the Solenoid Bracket Assembly. If necessary, the more complex change of the coil plunger, drive link, and spring should resolve all associated problems with the Upper Diverter Assembly.

See the accompanying diagram for details. The parenthetical numbers in the following procedure refer to the diagram's parts. (Some parts shown in the *Rollergames* manual (p. 61) are not used in this new assembly.)

PROCEDURE

NOTE: The following procedures require access to the upper portion of the playfield; however, the playfield can remain in the game, while the work is being done, and none of the playfield cables requires disconnection.

- Turn **OFF** the game.
- Remove the playfield glass.
- Lift the playfield from its tilting hinge brackets, until the upper portion is accessible.
- Place the playfield on the cabinet carefully to avoid damaging any parts.
- Remove the screws mounting the plastic shield to the end of the playfield.

1. Coin and Solenoid Bracket Assembly Replacement:

- A.** Unsolder the wires connected to the Coil, noting each wire's coil terminal.
- B.** Remove the solenoid bracket Mounting Screws (19), retaining them for reassembly.
- C.** Remove the AE-23-800 Coil (1), and replace it with an AE-26-1200 Coil.
- D.** Replace the Solenoid Bracket Assembly, p/n B-13488, (3) with a new revision A Assembly. (The revision A Solenoid Bracket Assembly has a slightly shorter solenoid stop than the original assembly.)
- E.** Mount the Coil (1) and Solenoid Bracket Assembly (3), as they were on the original unit; install and tighten the bracket Mounting Screws (19), using Loc-Tite.
- F.** Solder the wires to the new Coil, connecting them to the proper terminals (noted in step A).

2. Coil Plunger, Drive Link and Spring Replacement:

- A.** Remove the two "E" Rings attaching the old Diverter Drive Link to the two black, plastic Arm Assemblies; retain these "E" Rings for reassembly.
- B.** Remove the spring at the end of the old Drive Link; remove the old Drive Link, including the spring-attached Coil Plunger.
- C.** Replace all of the old Drive Link parts (coil plunger, springs, etc.) with the new Link-Plunger-Spring Assembly (10), p/n B-13843, sliding the plunger into the coil and inserting the post of each Arm Assembly (7) into the proper hole of the new Link-Plunger-Spring Assembly.
- D.** Attach an "E" Ring on each Arm Assembly post to reassemble the Link-Plunger-Spring Assembly. Slip the loop of the Spring into the hole of the Diverter bracket, where the old spring was removed.
- E.** Move the updated Diverter Assembly back and forth several times to verify that it is moving

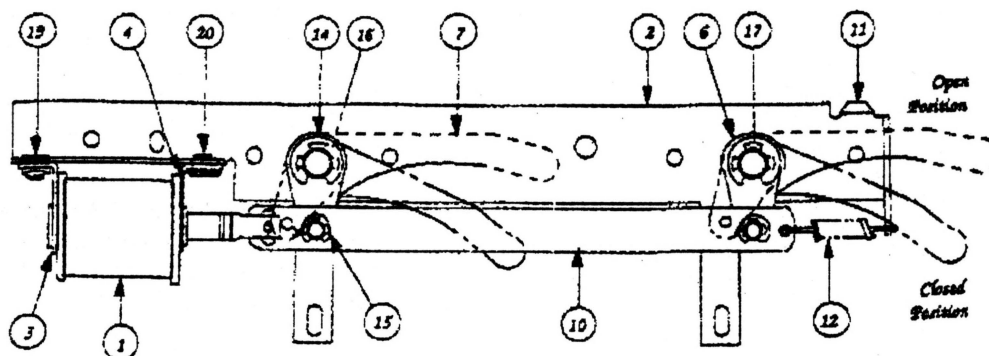
freely, without binding. If necessary, apply a small amount of Williams' Drop Target Grease (or similar lubricant) to the rotating posts on each Arm Assembly.

3. Final Preparation

A. After the Upper Diverter Assembly improvements are completed, reinstall the plastic shield

on the playfield, carefully reinstall the playfield in the game cabinet, and check to see that all cables are properly located (not kinking or binding).

B. Reinstall the playfield glass, and prepare the game for play. Play several games to verify that the Upper Diverter Assembly is operating satisfactorily. **NOTE:** Installation of Revision 2 (or higher) game software is recommended for satisfactory operation.



UPPER DIVERTER ASSEMBLY
P/N C-13489, REV. C

<u>Item</u>	<u>Part Number</u>	<u>Description</u>	<u>Item</u>	<u>Part Number</u>	<u>Description</u>
1	AE-12-2600	Coil Assembly	12	10-362	Spring
2	C-13490	Diverter Bracket Assy	13	Not Used on Rev C	
3	B-13488	Solenoid Bracket Assy	14	20-8712-25	"E" Ring, 1/4" Shaft
4	01-8-508-S	Solenoid Bracket	15	20-8712-18	"E" Ring, 3/16" Shaft
5	Not Used on Rev C		16	4700-00073-00	Flatwasher
6	A-13491	Drive Arm Assy	17	20-8716-2	Roll Pin, 3/32 x 5/8
7	C-13432	Diverter Gate/ Shaft Assy	18	Not Used on Rev C	
8	Not Used on Rev C		19	4008-01017-06	M/Screw, #8-32 x 3/8
9	Not Used on Rev C		20	4006-01003-06	M/Screw, #6-32 x 3/8
10	B-13843	Plunger Assembly			
11	23-6577	Rubber Bumper			

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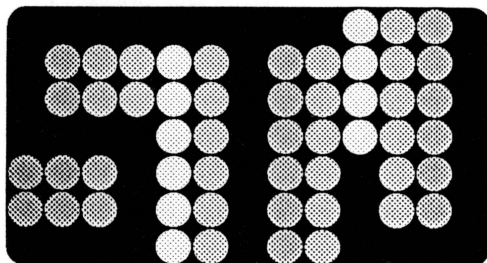
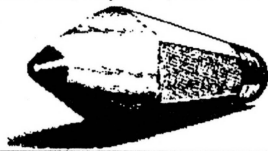
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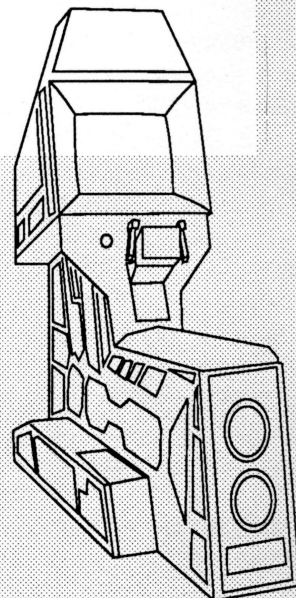
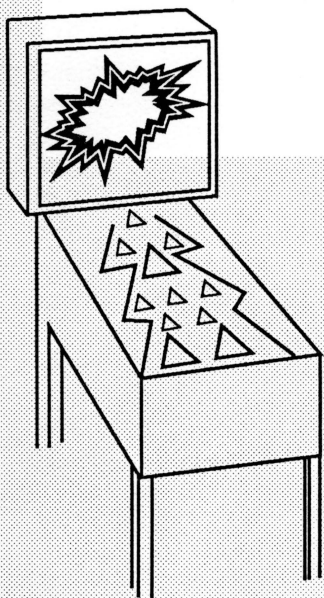


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DATES & SITES:

Aug 25/26	<i>Commercial Music</i>	Dallas, TX
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Sept 29/30	<i>STAR★TECH</i>	Atlanta, GA
Oct 13/14	<i>STAR★TECH</i>	Los Angeles, CA
Nov 16/17	<i>New Way Sales</i>	Toronto, Ontario

INFORMATION & REGISTRATION HEADQUARTERS

STAR★TECH JOURNAL SEMINAR (ADVANCING TECHS): STAR★TECH Journal, PO Box 1065, 18 North Centre Street, Merchantville, NJ 08109. 609/662-1080. Fax: 609/662-0537.

TUITION: Advance registration is \$250 per person. There is a 10% discount for multiple registrations from the same company. Classes are limited --register now! Late Registration is \$275 (less than seven days prior to seminar date). * Many thanks to these Distributors who have provided us the use of their facilities so that we can keep these tuition costs low.

REGISTRATION INFORMATION: Each person may register by selecting the Seminar date & site of their choice and by sending this information along with their name, company, address, phone number and tuition payment to the registration headquarters listed above. Make checks payable to STAR★TECH Journal, Inc.. Information packages including hotel accommodations & class schedule will be sent upon receipt. Class hours: Saturday: 9:00 am - 5:00 pm (6 hrs class), Sunday: 8:00 am - 3:30 pm (6 hrs class). Certificate of Completion awarded.

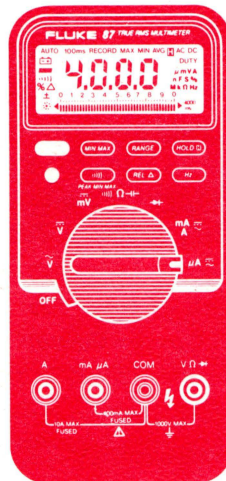
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- Min Max Average recording mode with Min Max Alert
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- Splash proof and dust proof case EMI shielded
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- Made in U.S.A.
- Three year warranty

The new Fluke 80 Series (83, 85 and 87) is a family of versatile analog/digital multimeters with an impressive range of capabilities, including frequency, duty cycle and capacitance measurement. Designed for electronic applications, the 80 Series features durable construction and several unique safety features.



MIN MAX AVG RECORDING MODE W/MIN MAX ALERT

Stores the highest, lowest and average of all readings, allowing you to monitor a signal for seconds or days. Selectable response times allow you to specify the time required to sense changes. Min Max Alert gives an audible tone for readings above or below previous minimums or maximums.

FREQUENCY, DUTY CYCLE AND CAPACITANCE

Fluke 80 Series meters have a counter for frequency measurements from 0.5 Hz to 200 kHz, and duty cycle measurements from 0.1% to 99.9% of cycle. All three meters measure capacitance from 10 pF to 5 uF. Larger value capacitors may be measured using the analog display in the resistance mode.

FAST 3-3/4-DIGIT, 4000 COUNT DIGITAL DISPLAY, HIGH RESOLUTION ANALOG DISPLAY

Digital display updates 4 times/second. For changing or unstable signals, the 87 features a high-resolution analog pointer; the 83 and 85 use an analog bargraph. The 83 and 85 also feature Zoom Mode for higher resolution analog readings. Analog displays update 40 times per second.

4-1/2 DIGIT MODE, 1MS PEAK HOLD, TRUE-RMS, BACK-LIT DISPLAY (87 ONLY)

The Fluke 87 is a true-rms ac meter, and offers 4-1/2 digit, 19,999 count high resolution mode, plus 1ms Peak Min Max hold. The back lit display assures readability in poorly lit settings. Light shuts off automatically after 68 seconds, prolonging battery life.

TOUCH HOLD & RELATIVE MODES

Touch Hold captures the measurement, beeps and locks it on the digital display until you're ready to view it. It automatically updates with each new measurement. The Relative Mode remembers a reading and shows the change (difference) between it and any readings that follow.

RUGGED, SEALED CONSTRUCTION

Splash proof and dust proof case and a specially designed protective holster protect the meter even under harsh operating conditions. All units are sealed and EMI shielded.

STANDARD EQUIPMENT

Every meter comes packaged with a yellow protective holster complete with Flex-Stand, safety-designed test leads, 9V battery (installed), manual and operator guide.

BASIC ACCURACY (% of reading + # of counts)

	83	85	87
DC Voltage	0.3%+1	0.1%+1	0.1%+1
AC Voltage	1%+3	0.5%+2	0.7%+2
True RMS	No	No	Yes
Specified to	5 kHz	20 kHz	20 kHz
Ohms	0.4%+1	0.2%+1	0.2%+1
DC Current	0.4%+2	0.2%+2	0.2%+2
AC Current	1.2%+2	0.6%+2	1%+2
Frequency	0.005%+1	0.005%+1	0.005%+1
Capacitance	1%+2	1%+2	1%+2

BATTERY LIFE: 500 hours typical (alkaline) (83,85). 400 hours typical (alkaline) (87). **THREE YEAR WARRANTY:** One year calibration interval. **SIZE:** 1.25" H x 3.41" W x 7.35" L. **WEIGHT:** 12.5 oz.

PRICE:

Fluke 83	\$ 185
Fluke 85	224
Fluke 87	283

TO ORDER: Send check or money order (US\$) to STAR★TECH Journal, PO Box 1065, Merchantville, NJ 08109. **COD orders ok.** Phone: 609/662-1080. Fax: 609/662-0537. NJ add 6%. All orders add \$8 s/h and insurance. Air shipping \$16.